REMARKS/ARGUMENTS

In the Office Action dated January 12, 2006, Claims 1-35 are pending. Claims 16-32 have been elected for prosecution, and the non-elected claims are cancelled above. Claims 29-31 are rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,915,964 to Tapphorn, et al. Claims 16, 17, 19-21, 23-25, and 32 are rejected under 35 U.S.C. § 102(e) as being anticipated by or under 35 U.S.C. § 103(a) as being unpatentable over Tapphorn, et al. Claims 18, 26, 27, and 32 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Tapphorn, et al. Claims 16, 22, 24, 25, and 29 are rejected under 35 U.S.C. § 103(a) as being unpatentable over GB 2,297,053 to Ruckert, et al. Claims 16, 20, 22, 29, and 31 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,257,309 to Kinane, et al. Dependent Claim 28 is indicated to be allowable if rewritten in independent form.

Applicant has amended Claims 16, 26, 29 above and cancelled Claims 21 and 22. New Claim 36 is added. The amendments incorporate features of dependent claims and do not introduce new matter. Reconsideration is requested in light of the amendments and the following remarks.

Applicant first addresses the rejection of independent Claim 29. Claim 29 is amended above to incorporate each of the features of previous Claim 32, which is now cancelled. Claim 32 stands rejected only as being anticipated by or unpatentable over Tapphorn, et al. Accordingly, Applicant submits that the rejections of Claim 29 in light of Ruckert, et al. and Kinane, et al. are overcome. As amended, Claim 29 recites a method that includes, among other steps, spraying particles of a structural material on a base member by directing a stream of the particles in a gas comprising hydrogen. After the spraying step, the preform is machined. Further, the preform is heated and subjected to a sub-atmospheric pressure, thereby releasing hydrogen from the structural material of the structural member. Thus, as now recited in Claim 29, the particles are disposed using hydrogen and then the preform is heated and subjected to a sub-atmospheric pressure to release hydrogen from the structural member. For example, the present application describes an embodiment in which particles of titanium or titanium alloy are deposited using a gas containing hydrogen such that "[d]uring the deposition of the structural material **16** on the base member **14**, small amounts of the hydrogen gas are trapped in pockets, bubbles, gaps, or other voids formed within the titanium." Thereafter, the preform or structural

member is heated and subjected to a sub-atmospheric pressure in a vacuum furnace. *See* page 9, line 25 – page 10, line 2.

The Office Action states:

> Regarding claims 18 and 32, Tapphorn teaches that the structural material may be sprayed with a reactive gas such as hydrogen. While Tapphorn does not teach that the hydrogen is released after the spraying step, it does teach that the hydrogen is released from the structural material (col. 29, ln. 1-41). It would have been within the purview of one of ordinary skill in the art to have recognized that the hydrogen could be desirably removed from the structural material at any point in the preform forming method. Absent a teaching of the criticality of the hydrogen being released after spraying as opposed prior to deposition of the structural material, it would not provide a patentable distinction over the prior art. Regarding the limitation that the structural material is subjected to a sub-atmospheric pressure when releasing the hydrogen, it would have been obvious to one of ordinary skill in the art to have used some form of vacuum or sub-atmospheric pressure in order to sufficiently remove the hydrogen from the structural material and prevent further reaction between the two materials.

Office Action, page 6.

Applicant respectfully disagrees. Tapphorn, et al. discloses the use of multiple powder reactors that expose the powder particles to different types of carrier gases to first convert metal powder particles to a metal hydride and then convert the metal hydride particles to an oxygen free metal that is then used in the coating process. Tapphorn, et al. does not teach or suggest any process for releasing hydrogen from the structural member, e.g., hydrogen that is "trapped in pockets, bubbles, gaps, or other voids formed within the titanium" during the deposition process. Indeed, Tapphorn, et al. does not even contemplate trapping hydrogen in the structural member during deposition. Moreover, the process of Tapphorn, et al. is distinctly different than that of Claim 29. In the described process of Tapphorn, et al., the hydrogen is provided to convert the metal powder particles to metal hydride, and the subsequent use of helium is for converting the metal hydride particles to oxygen free metal. Tapphorn, et al. does not teach or suggest that the same result can be achieved by depositing metal hydride particles and then somehow converting the hydride particles to an oxygen free metal. Nor does Tapphorn, et al. provide any suggestion of achieving the result of the present invention, i.e., the release of hydrogen that is trapped by the particles during deposition.

Accordingly, Applicant respectfully submits that Claim 29 is allowable, as are the dependent Claims 30 and 31.

Applicant now addresses the rejection of independent Claim 16. Claim 16 is amended above to incorporate dependent Claim 21, and Claim 21 is cancelled. Claim 21 stands rejected only as being anticipated by or unpatentable over Tapphorn, et al. Accordingly, Applicant submits that the rejections of Claim 16 in light of Ruckert, et al. and Kinane, et al. are overcome. As amended, Claim 16 recites a method that includes, among other steps, providing a base member according to the dimensions of a structural member and spraying particles of a structural material on the base member. After the spraying step, the preform is plastically deformed according to the dimensions of the structural member, and this deformation step includes deformation of the base member.

Tapphorn, et al. does not teach or suggest a method in which a base member of a preform is deformed after deposition of particles thereon. In this regard, the Office Action states:

> Regarding claim 21, although Tapphorn does not explicitly recite the base member is deformed, the plastic deformation of the particles during spraying would also result in plastic deformation of the base member. Furthermore, the post formation processes recited above could also involve deformation of the base member. Absent a teaching of the criticality or showing of unexpected results, the claimed step of deforming the base member would not provide a patentable distinction over the prior art.

Office Action, page 5.

Applicant disagrees. The present application describes a distinct method by which particles are disposed onto a base member and then the base member is deformed to achieve the predetermined dimensions of a structural member. This aspect of the invention is described in the application, e.g., in connection with Figures 4-6, the application describes that the base member **14** can be plastically deformed by a forging process that is performed after the spraying process. *See* the present application at page 10, line 28 – page 11, line 18. This provides a distinct difference over processes in which the preform is not deformed after spraying, e.g., by enabling the manufacture of detailed and/or complex configurations that are difficult or impossible to form by spraying alone. *See* the present application at page 3, lines 9-20.

Even if the deposition of the particles in the process of Tapphorn, et al. causes a deformation of the base member, Tapphorn, et al. does not teach or suggest deforming the base member after the spraying process as claimed. Further, the "post forming processes" referred to in the above quotation from the Office Action apparently refer to annealing, hot isostatic pressing, heat treating, and machining or polishing. Tapphorn, et al. does not teach that any of these processes cause any deformation and, in particular, a deformation of the base member, and it is unclear why or how such processes of Tapphorn, et al. would deform the base member. For example, the Office Action states elsewhere that a "teaching that the preform is machinable is taken as a teaching that the preform is intended to be plastically deformed by machining," but Applicant disagrees with this suggestion that a removal of material from the structural member is the same as the plastic deformation of the base member of the structural member.

In any case, Tapphorn, et al. fails to disclose any step of deforming a base member after the deposition of particles thereon, and fails to provide any motivation for performing such an operation. Indeed, any plastic deformation that occurs during the spraying operation occurs to achieve the deposition of the particles, and this does not provide any motivation for subsequently deforming the base member.

Accordingly, Applicant submits that Claim 16 is allowable, as are each of the dependent Claims 17-20 and 22-25.

In addition, the dependent claims provide other patentable distinctions over the cited references. For example, dependent Claim 18 recites that "said spraying step comprises directing a stream of the particles in a gas comprising hydrogen, and further comprising subjecting the structural material to a sub-atmospheric pressure after said spraying step to thereby releasing hydrogen from the structural material." As discussed above in connection with Claim 29, Tapphorn, et al. does not teach this aspect of the present invention, and Claim 18 is therefore allowable over Tapphorn, et al. for this additional reason.

Dependent Claim 24 recites that "said plastically deforming step comprises urging the preform against a forming surface of at least one die and thereby forging the preform." In this regard, the Office Action states that "Tapphorn's teaching of isostatic pressing would meet the limitation of the preform being urged against a forming surface and thereby forging the preform." Applicant disagrees. Tapphorn, et al. states that hot isostatic pressing can be used, but

does not describe the hot isostatic process as involving the use of any dies or other forming surfaces for forging as claimed. Moreover, hot isostatic pressing does not require the claimed steps. Indeed, as explained in the present application, hot isostatic pressing (HIP) "can be performed by subjecting the preform **10** or the structural member **12** to a pressure above 15,000 psi, or above 30,000 psi in some embodiments, and an elevated HIP temperature." Page 13, lines 15-17. No die, forming surface, or forging is required for this process.

Independent Claim 26 is rejected on the sole basis of being unpatentable over Tapphorn, et al. per § 103(a). Claim 26 is directed to a method that includes spraying particles of a structural material on a base member to form a preform, subjecting the preform to a sub-atmospheric pressure, and then cold isostatically pressing the preform to reduce a porosity of the preform. The Office Action acknowledges that "Tapphorn is silent to subjecting the preform to a sub-atmospheric pressure and subsequently cold isostatically pressing to reduce the porosity." Office Action, page 7. Nevertheless, the Office Action asserts that it would have been obvious "to have used some form of vacuum or sub-atmospheric pressure in order to sufficiently remove the hydrogen from the structural material and prevent further reaction between the two materials." Office Action, page 7. Applicant disagrees. As explained above, Tapphorn, et al. describes the use of hydrogen in a distinctly different process, i.e., for converting metal to metal hydride, after which helium is used to convert the metal hydride to oxygen free metal. Tapphorn, et al. provides no teaching or suggestion for removing hydrogen from a sprayed structural member. Indeed, Tapphorn, et al. does not disclose that hydrogen may be trapped by the spraying process and provides no motivation for removing trapped hydrogen. Applicant finds no teaching or suggestion in Tapphorn, et al. of a sub-atmospheric pressure. Again, Tapphorn, et al. does not even acknowledge a motivation for removing trapped hydrogen, let alone the use of a sub-atmospheric pressure for doing so. Absent any showing of these aspects in the cited references, the rejection of Claim 26 is based only on hindsight based on the motivations and teachings set forth in the present application.

Accordingly, Applicant respectfully submits that Claim 26 is allowable, as is the dependent Claim 27.

New independent Claim 36 incorporates all of the features of previous Claims 20 and 22, including previous Claim 16, from which Claims 20 and 22 depended. Claim 22, now cancelled,

was rejected under § 103(a) as being unpatentable over Ruckert, et al. and Kinane, et al. Applicant traverses. As now set forth in independent Claim 36, the method includes determining desired dimensions of a structural member, and providing a mold that corresponds to those dimensions. Particles of a structural material are sprayed on the mold in a mixed stream having a temperature sufficiently low to prevent melting of the structural material to form a preform, and the structural material is then removed from the mold. Thereafter, the preform is plastically deformed according to the dimensions of the structural member so that the preform has dimensions approximating the desired dimensions. Thus, Claim 36 recites a cold spraying method for forming a preform in a mold and then deforming the preform. Neither Ruckert, et al. nor Kinane, et al. teaches this method. Ruckert, et al. fails to teach or suggest the use of a mold in a cold spraying operation. Indeed, the Office Action states that "Ruckert is silent to providing a mold and removing the structural material from the mold." Office Action, page 8. Further, Ruckert, et al. is specifically directed to a method in which a melt of an alloy is finely sprayed so that "the mist of melt is deposited to give a growing body." *See* page 7, first paragraph. The use of a melt is explicitly taught by Ruckert, et al., which states, e.g., "[s]ince a single melt is atomized, no mixing inhomogeneities can be formed." *See* page 8, first paragraph. Even if Ruckert, et al. taught a mold, it would not have been obvious to use cold spraying as Ruckert, et al. teaches away from that process.

Kinane, et al. fails to teach deforming a preform to form a structural member. To the contrary, Kinane, et al. is directed to a method for making tools by spray forming deposits of steel onto a pattern **14** that corresponds to a master pattern **10**. *See* col. 1, lines 6-9; col. 2, lines 36-65. After the pattern is removed from the deposit, "the deposit **44** is an exact negative of the pattern **14**, or an exact replica of the master **10** and then can be used as a die or mold part accordingly." Col. 5, lines 27-30. The Office Action acknowledges that Kinane, et al. does not teach deforming the preform, but asserts that "the teaching that the preform is machinable is taken as a teaching that the preform is intended to be plastically deformed by machining." Office Action, page 9. Applicant disagrees. Even if the deposit **44** of Kinane, et al. is machinable, Kinane, et al. does not disclose any method of machining. Moreover, Claim 36 recites a particular step of plastically deforming the preform. To the extent that the Office Action suggests that machining is the same as plastically deforming, Applicant traverses.

Merely removing material by machining does not require or suggest a plastic deformation operation. Further, in light of the above-noted teachings of Kinane, et al., it would not have been obvious to plastically deform the deposit **44** after specifically forming the deposit **44** to be an exact replica of the master **10**.

Accordingly, Applicant submits that Claim 36 is allowable over the cited references.

For the above reasons, Applicant respectfully submits that Claims 16, 17, 19, 20, 23-31, and 36 are allowable, as well as Claim 28, which has already been indicated to be allowable.

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Conclusion

In view of the remarks made above, Applicants submit that the pending claims are now in condition for allowance. Applicants respectfully request that the claims be allowed to issue. If the Examiner wishes to discuss the application or the comments herein, the Examiner is urged to contact the undersigned by telephone.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,

/Nicholas F. Gallo/

Nicholas F. Gallo
Registration No. 50,135

Customer No. 00826
ALSTON & BIRD LLP
Bank of America Plaza
101 South Tryon Street, Suite 4000
Charlotte, NC 28280-4000
Tel Charlotte Office (704) 444-1000
Fax Charlotte Office (704) 444-1111
CLT01/4783598v1